

# EXHIBIT 24

**Name** : S. E. Elghobashi  
**Nationality** : U.S.A.

June 2016

**Education** :

<b>Degree</b>	<b>Year</b>	<b>Institution</b>
M.Sc. ( Mechanical Engineering )	1971	Univ. of Southern California, Los Angeles, USA.
Ph.D. ( Mechanical Engineering )	1974	Imperial College, University of London, England.
D.Sc. ( Mechanical Engineering )	1999	Imperial College, University of London, England.

**Professional Activities (partial list)**

**Member of the National Academy of Engineering.**

**Fellow of the American Physical Society.**

**Fellow of the American Association for the Advancement of Science.**

**Fellow of the American Society of Mechanical Engineers.**

**Visiting Fellow of Cambridge University, Wolfson College, England, 1999.**

**Senior Award of International Conference on Multiphase Flow, Florence, Italy, May 25, 2016.**

**Chair of the Nominating Committee of American Physical Society, Div. Fluid Dynamics (2014-2015).**

**Member of Fellowship Committee of American Physical Society, Div. Fluid Dynamics (2009-11).**

**Member of Science and Engineering Advisory Committee (SETAC) of Blue Waters supercomputer project(2016-2017). <https://bluewaters.ncsa.illinois.edu/setac>**

**Senior member of the American Institute of Aeronautics and Astronautics(AIAA).**

**Member of the Combustion Institute.**

**Member of EuroMech.**

**Member of the Editorial Advisory Board of International J. of Multiphase Flow(2010-present).**

**Guest Editor of International J. of Multiphase Flow, Special Issue on Point-particle model for disperse turbulent flows, vol. 35, 2009.**

**DIC: Diploma of Membership of Imperial College in Mech. Engineering, 1974.**

**British Science Research Council (SRC) Scholarship (1971-1974).**

**Major Research Interests**

Direct numerical simulation of turbulent flows, including multiphase and chemically-reacting flows, and biomedical flows.

**Research and Professional Experience**

March 2015 -Present **UC Distinguished Professor**, Mechanical and Aerospace Engineering Department, University of California, Irvine.

July 1985 - Feb. 2014 **Professor**, Mechanical and Aerospace Engineering Department, University of California, Irvine.

July 1997 - June 2002 **Chairman**, Mechanical and Aerospace Engineering Department, University of California, Irvine.

Aug. 1984 - July 1985 **Visiting Scientist**, DFVLR, German Aerospace Research Establishment, Institute of Atmospheric Physics, Oberpfaffenhofen, West Germany ( Sabbatical Year).

July 1983 - July 1984 **Vice Chairman**, Mechanical Engineering Department, University of California, Irvine.

July 1982 - June 1985 **Associate Professor**, Mechanical Engineering Department, University of California, Irvine.

July 1978 - June 1982 **Assistant Professor**, Mechanical Engineering Department, University of California, Irvine.

Jan. 1978 - June 1978 **Staff Research Engineer**, Acurex Corporation, Aerotherm Division, Mountain View, California.

Oct. 1974 - Dec. 1977 **Group Leader**, CHAM, ( Concentration, Heat and Momentum), London, England and Huntsville, Alabama.

**Reviewer for:**

Journal of Fluid Mechanics  
Physics of Fluids  
Nature  
Science  
Physical review Letters  
International Journal of Multiphase Flow  
Journal of Combustion Science and Technology  
Combustion and Flame  
Journal of American Institute of Aeronautics and Astronautics  
Journal of Fluids Engineering  
Journal of Heat Transfer  
International Journal of Numerical Heat Transfer  
International Journal of Heat and Mass Transfer  
International Journal of Heat and Fluid Flow  
Progress in Energy and Combustion Science  
Journal of Applied Mathematical Modeling  
National Science Foundation  
NASA  
Department of Energy  
University of California Energy Research Group  
McGraw Hill Book Co.  
John Wiley Book Co. and Wiley Interscience Europe.

**Consulting**

**1974 - 1978**

NASA- Lewis, NASA- Langley, NASA- Marshall, AFOSR, ARO, ONR

Westinghouse, General Electric, Airesearch  
ALCAN, ALCOA, Corning, Phillip Morris  
Ballistic Missile Advance Technology Center  
Rolls-Royce, England  
Rheinmetall, Germany  
Societe National des Poudres et Explosifs, France  
Spectron Development Labs.

**1981 - 1996**

Jet Propulsion Laboratory  
Ballistic Missile Advance Technology Center  
R&D Associates  
Physical Research Inc.  
P D A Engineering  
**1978 - 2000**

Science Applications Inc.

**Invited Keynote and Distinguished Lectures since 2000**

**L1.** Elghobashi, S. " On the two-fluid and trajectory approaches for DNS of turbulent particle-laden flows", Part 1: DNS of bubble-laden flows via the two-fluid approach, [ **Invited Lecture** ] Von Karman Institute for Fluid Dynamics, Rhode-Saint-Genese, **Belgium**, April 3-7, 2000.

**L2.** Elghobashi, S. " On the two-fluid and trajectory approaches for DNS of turbulent particle-laden flows", Part 2: On the approximation of the two-way coupling terms in the trajectory approach, [ **Invited Lecture** ] Von Karman Institute for Fluid Dynamics, Rhode-Saint-Genese, **Belgium**, April 3-7, 2000.

**L3.** Elghobashi, S. " On the point-force approximation in DNS of particle-laden turbulent flows with two-way coupling", [ **Invited lecture** ] ERCOFTAC Conference on Dynamics of Particle-Laden Flows, Zurich, **Switzerland**, July 3-5, 2000.

**L4.** L4. Elghobashi, S. "Recent Advance in DNS of Particle-Laden Turbulent Flows" [ **Invited Plenary lecture** ], XI Congress on Numerical Methods and their Applications, ENIEF 2000 , San Carlos de Bariloche, **Argentina**, November 20-24, 2000.

**L5.** L5. Elghobashi, S. "The physical mechanisms of modifying the structure of turbulent homogeneous flows by dispersed particles ", [ **Invited Plenary Lecture** ], ERCOFTAC Conference on Small Particles in Turbulence , Seville, **Spain**, March 11-13, 2002.

**L6.** S. Elghobashi "On the physical mechanisms of drag reduction in a microbubble-laden turbulent boundary layer" [ **Keynote Lecture** ] at **The 5th International Con-**

ference of Multiphase Flow (ICMF 2004), Yokohama, **Japan**, May 31 - June 3, 2004.

**L7.** S. Elghobashi “On the drag reduction in a mirobubble-laden spatially-developing turbulent boundary layer”, **IUTAM Symposium** on Recent advances in disperse multiphase flow simulation- **[Invited Lecture]**- Chicago-October 2004.

**L8.** S. Elghobashi “ Reynolds number effect on drag reduction in a microbubble-laden spatially-developing turb. boundary layer”, **Euromech Conference on Hydrodynamics of bubbly flows- [Invited Lecture]**- Lorentz Center, Leiden, **the Netherlands**, June 6-8, 2005.

**L9.** S. Elghobashi “On drag reduction in a microbubble-laden spatially-developing turbulent boundary layer”, **European Science Foundation- Challenging Turbulent Lagrangian Dynamics, [Invited Lecture]**- Castel Gandolfo, **Italy**, Sept. 1-4, 2005.

**L10.** S. Elghobashi “On drag reduction in a microbubble-laden spatially-developing turbulent boundary layer”, **Thirteen IUTAM Advanced School & Workshop, Particle Dispersion in Turbulent Flows, [Invited Lecture I]** - CISM, Udine, **Italy**, September 12-16, 2005.

**L11.** S. Elghobashi “ Reynolds number effect on drag reduction in a microbubble-laden spatially-developing turb. boundary layer”, **Thirteen IUTAM Advanced School & Workshop, Particle Dispersion in Turbulent Flows, [Invited Lecture II]**- CISM, Udine, **Italy**, September 12-16, 2005.

**L12.** S. Elghobashi, “ Direct simulation of turbulent flows laden with particles or bubbles”, **CIEMAT : Research Centre for Energy, Environment and Technology, [Invited Lecture]**, Madrid, **Spain**, June 21, 2006.

**L13.** S. Elghobashi, “ DNS of the two-way interactions between dispersed solid particles and turbulent flows”, **Workshop on multiphase turbulence: Dust storms, erosion, hurricanes and tornadoes, [Invited Lecture]**, Xian, **China**, July 16-18, 2007.

**L14.** S. Elghobashi, “ On the two-way interactions between dispersed solid particles and turbulent flows”, **European Workshop on Direct and Large-Eddy Simulation, [ Keynote Lecture]**, Trieste, **Italy**, Sept. 8-10, 2008.

**L15.** S. Elghobashi “ On the two-way interactions between dispersed particles and turbulent flows ” , **March 2009 Meeting of American Physical Society** Pittsburgh, PA . Bulletin of APS, Vol. 54, 209, **[Invited Lecture]**, March 18, 2009.

**L16.** S. Elghobashi “ The physical mechanisms of two-way interactions between dispersed particles and turbulent flows”, **Workshop on Clouds and Turbulence Institute for Mathematical Sciences**, Imperial College, [Invited Lecture], London, **England**, March 23-25, 2009.

**L17.** S. Elghobashi “ How do inertial particles modify isotropic turbulence ?” **International Workshop- Solving the Riddle of Turbulence: What, Why, and How?** Max Planck Institute for Dynamics and Self-Organization, [Invited Lecture], Göttingen, **Germany**, May 6 - May 9, 2009.

**L18.** S. Elghobashi “How do inertial particles modify isotropic turbulence ?” **International Symposium on Turbulence**”, [Invited Lecture], Peking University, **Beijing, China**, Sept. 21-25, 2009.

**L19.** S. Elghobashi “How do inertial particles modify isotropic turbulence ?” **4th Latin-American Workshop on CFD ”**, [Keynote Lecture], Rio de Janeiro, **Brazil**, July 11-14, 2010.

**L20.** S. Elghobashi “On turbulence modulation by dispersed inertial particles” **13th European Turbulence Conference, ETC 13, [Keynote Lecture]** University of Warsaw, **Poland**, September 12-15, 2011.

**L21.** F. Lucci, V.S. Lvov, A. Ferrante and S. Elghobashi, “Eulerian-Lagrangian bridge for the energy and dissipation spectra in homogeneous turbulence”, [Invited Lecture], International Workshop on “Lagrange versus Euler for turbulent flows”, **Wolfgang Pauli Institute, Vienna, Austria**, May 7-12, 2012.

**L22.** S. Elghobashi “On the multi-way interactions between turbulent flows and suspended sediment”

**International symposium on two-phase modeling for sediment dynamics in geophysical flows(THESIS-2013) [Keynote Lecture]** Chatou, Paris, **France**, June 10-12, 2013.

**L23.** S. Elghobashi “On the multi-way interactions between turbulent flows and suspended particles”

**Fluid-Mediated Particle Transport in Geophysical Flows (GEOFLOWS13)**, Kavli Institute for Theoretical Physics [Invited Lecture] UCSB, Santa Barbara, **California**, December 10, 2013.

**L24.** S. Elghobashi “ Modulation of isotropic turbulence by dispersed particles,” **Huazhong University of Science and Technology, Wuhan, China**, June 9, 2014. [Plenary Lecture].

**L25.** S. Elghobashi “Homogeneous shear turbulence modulation by dispersed small

particles,” **Huazhong University of Science and Technology, Wuhan, China**, June 10, 2014. [keynote Lecture].

**L26.** S. Elghobashi “Modulation of isotropic turbulence by finite-size particles,” **Huazhong University of Science and Technology, Wuhan, China**, June 11, 2014. [keynote Lecture].

**L27.** S. Elghobashi “How do dispersed inertial particles modify turbulent flows,” Department of Mechanics and Engineering Science, **Peking University, China**, June 17, 2014 . [Distinguished lecture].

**L28.** S. Elghobashi “How do dispersed inertial particles modify turbulent flows,” Center for Turbulence Research, **Stanford University**, July 25, 2014. [Distinguished lecture].

**L29.** S. Elghobashi “How do dispersed inertial particles modify turbulent flows,” Computational and Applied Mathematics, **Pennsylvania State University**, October 10, 2014. [Distinguished lecture].

**L30.** S. Elghobashi “How do dispersed inertial particles modify turbulent flows,” Aerospace Engineering department, **University of Minnesota**, April 21, 2015. [Distinguished lecture].

**L31.** S. Elghobashi “How do dispersed inertial particles modify turbulent flows,” Mechanical Engineering department, **Northwestern University**, February 1, 2016. [Distinguished lecture].

**L32.** S. Elghobashi “How do dispersed inertial particles modify turbulent flows,” Mechanical Engineering department, **MIT**, February 3, 2016. [Distinguished lecture].

## Publications

### Articles in Books

**B1** Elghobashi, S.E., "Studies in the Prediction of Turbulent Diffusion Flames", **Studies in Convection**, Vol. 2, B.E. Launder, ed., Academic Press, London, (1977).

**B2** Elghobashi, S. E., and Nomura, K.N., "Direct Simulation of a Passive Diffusion Flame in Sheared and Unsheared Homogeneous Turbulence", **Turbulent Shear Flows 7**, pp. 313-329, W.C. Reynolds, ed., Springer-Verlag, (1991).

**B3** Elghobashi, S. E. "Direct Simulation of turbulent flows laden with dispersed particles", **Handbook on Multiphase Flow**, pp. 13-34:13-60, C. Crowe, ed., CRC, (2005).

**B4** Elghobashi, S. E. "An updated classification map of particle-laden turbulent flows", **Proceedings of IUTAM Symposium on Computational approaches to multiphase flow**, Springer pp. 3-10, , (2006).

**B5** Loy, A.C., Jing, J., Zhang, J., Wang., Y., Elghobashi, S., Chen, Z. and Wong, B.J.F. "Anatomic optical coherence tomography of upper airways", **Optical Coherence Tomography: Technology and Applications**, Ed. W. Drexler and J. Fujimoto, Springer, Chapter 75, pp. 1145-2262, (2015).

### Guest Editor

Elghobashi, S.E. " Point-Particle Models for Disperse Turbulent Flows", **International Journal of Multiphase Flow, Special Issue**, Volume 35, Issue 9, Pages 791-878, (September 2009).

### Journal Papers

**J1** Elghobashi, S.E., Pun, W.M. and Spalding, D.B., "Concentration Fluctuations in Isothermal Turbulent Confined Coaxial Jets", **Chem. Eng. Sci.**, Vol. 32, pp. 161-166 (1977).

**J2** Elghobashi, S.E. and Wassel, A.T., "The Effect of Turbulent Heat Transfer on the Propagation of an Optical Beam Across Supersonic Boundary and Free Shear Layers", **Int. J. Heat and Mass Transfer**, Vol. 23, pp. 1229-1241 (1980).

**J3** Elghobashi, S.E., Samuels, G.S., Wuerer, J.E., and LaRue, J.C., " Prediction and Measurement of Mass, Heat and Momentum Transport in a Nonreacting Turbulent Flow of a Jet in an Opposing Stream", **J. Fluids Engineering**, Vol. 103, pp. 127-132 (1981).

**J4** Megahed, I.E.A. and Elghobashi, S.E., "On the Numerical Solution of Indeterminate Steady Elliptic Flows", **Computer Methods in Applied Mechanics and Engineering**, Vol. 26, pp. 225-240 (1981).

**J5** Elghobashi, S.E. and Megahed, I.E.A., "Mass and Momentum Transport in a Laminar Isothermal Two-Phase Round Jet", **Int. J. Numerical Heat Transfer**, Vol. 4, pp. 317-329 (1981).

**J6** Elghobashi, S.E. and Abou Arab, T.W., "A Two-Equation Turbulence Model for Two-Phase Flows", **Physics of Fluids**, Vol. 26, pp. 931-938 (1983).

**J7** Elghobashi, S.E. and Launder, B.E., "Turbulent Time Scales and the Dissipation Rate of Temperature Variance in the Thermal Mixing", **Physics of Fluids**, Vol. 26, pp. 2415-2419 (1983).

**J8** Modarress, D., Tan, H. and Elghobashi, S.E., "Two-Component LDA Measurement in a Two-Phase Turbulent Jet", **AIAA J.** Vol. 22, pp. 624-630 (1984).

**J9** Modarress, D., Wuerer, J. and Elghobashi, S.E., "An Experimental Study of a Turbulent Round Two-Phase Jet", **Chemical Engineering Communications**, Vol. 28, pp. 341-354 (1984).

**J10** Wassel, A.T. and Elghobashi, S.E., "Mathematical Simulation of Ocean Thermal Energy Conversion Sea Water Systems", **J. Solar Energy Engineering** Vol. 106, pp. 198-205 (1984).

**J11** Mostafa A.A. and Elghobashi, S.E., "A Study of the Motion of Vaporizing Droplets in a Turbulent Flow", **AIAA Progress in Astronautics and Aeronautics**, Vol. 10, pp. 513-539, Oppenhiem and Soloukhin (editors) (1984).

**J12** Elghobashi, S.E., Abou-Arab, T., Rizk, M. and Mostafa, A., "Prediction of the Particle-Laden Jet with a Two-Equation Turbulence Model", **Int. J. of Multiphase Flow**, Vol. 10, pp. 697-710 (1984).

**J13** Bellan J., and Elghobashi, S.E., "Fuel Composition Effects on High Temperature Corrosion in Boiler and Furnaces", **J. of Engineering for Power**, Vol. 107, pp. 744-757 (1985).

**J14** Rizk, M., and Elghobashi, S.E., "Wall Effects on the Motion of a Spherical Particle Suspended in a Turbulent Flow", **Physics of Fluids**, Vol. 28, pp. 806-817 (1985).

**J15** Mostafa, A.A. and Elghobashi, S.E., "A Two-Equation Turbulence Model for Jet Flows Laden with Vaporizing Droplets", **Int. J. of Multiphase Flow**, Vol. 11, pp. 515-533 (1985).

**J16** Schumann, U., Elghobashi, S.E., and Gerz, T., "Direct Simulation of Stably Stratified Turbulent Homogeneous Shear Flows", **Notes on Numerical Fluid Mechanics**, Vol. 15, pp. 245-264 (1986).

**J17** Prud'homme, M., and Elghobashi, S.E., "Turbulent Heat Transfer Near the Reattachment of Flow Downstream of a Sudden Pipe Expansion", **Int. J. Numerical Heat Transfer**, Vol. 10, pp. 349-368 (1986).

**J18** Conner, J. and Elghobashi, S.E., "Numerical Solution of Laminar Flow Past a Sphere with Surface Mass Transfer", **Int. J. Numerical Heat Transfer**, Vol. 12, pp. 57-82 (1987).

**J19** Rizk, M. and Elghobashi, S.E., "A Two-Equation Turbulence Model for Dispersed Dilute Two-Phase Confined Flows", **Int. J. of Multiphase Flow**, Vol. 15, pp. 119-133 (1989).

**J20** Gerz, T., Schumann, U. and Elghobashi, S., "Direct Simulation of Stably Stratified Homogeneous Turbulent Shear Flows", **J. Fluid Mechanics**, Vol. 200, pp. 563-594 (1989).

**J21** Tsau, F. , Elghobashi, S. E.,and Sirignano, W. " Effects of G- Jitter on a Thermally Buoyant Flow", **J. Thermophysics and Heat Transfer**, vol. 6, pp. 246-254 (1992).

**J22** Elghobashi, S. E., "Particle-Laden Turbulent Flows : Direct Simulation and Closure Models ", **J. Applied Scientific Research**, vol.48, pp. 301-314 (1991).

**J23** Elghobashi, S. E.,and Truesdell, G.C., "Direct Simulation of Particle Dispersion in a Decaying Isotropic Turbulence", **J. Fluid Mechanics**, vol. 242, pp. 655-700 (1992).

**J24** Nomura, K.N.,and Elghobashi, S. E. "Mixing characteristics of an inhomoge-

neous scalar in isotropic and homogeneous sheared turbulence",  
**Physics of Fluids**, vol. 4, pp. 606-625 (1992).

**J25** Kim, I. , Elghobashi, S. E., and Sirignano, W. " Three- dimensional flow over two spheres placed side by side",  
**J. Fluid Mechanics**, vol. 246, pp. 465-488 (1993).

**J26** Nomura, K.N.,and Elghobashi, S. E. " The structure of inhomogeneous turbulence in variable density nonpremixed flames",  
**Theoretical and Computational Fluid Dynamics**, vol. 5, pp. 153-176 (1993).

**J27** Elghobashi, S. E., and Truesdell, G.C., " On the two-way interaction between homogeneous turbulence and dispersed solid particles ; Part 1 : turbulence modification",  
**Physics of Fluids**, vol. A5, pp. 1790-1801 (1993).

**J28** Elghobashi, S. E., 'On Predicting Particle-Laden Turbulent Flows' ,  
**J. Applied Scientific Research**, Vol. 52, 4, pp. 309-329 (1994).

**J29** Truesdell, G.C., and Elghobashi, S. E." On the two-way interaction between homogeneous turbulence and dispersed solid particles ; Part 2 : particle dispersion",  
**Physics of Fluids**, Vol. 6, pp. 1405-1407 (1994).

**J30** Kim, I. , Elghobashi, S. E., and Sirignano, W. " Unsteady flow interactions between an advected cylindrical vortex tube and a spherical particle",  
**J. Fluid Mechanics**, Vol. 288, pp. 123-155 (1995).

**J31** Boratav, O. , Elghobashi, S. E., and Zhong, R. " On the alignment of the  $\alpha$ -strain and vorticity in turbulent nonpremixed flames",  
**Physics of Fluids**, Vol. 8, pp. 2251-2253 (1996).

**J32** Kim, I. , Elghobashi, S. E., and Sirignano, W. " Unsteady flow interactions between a pair of advected vortex tubes and a rigid sphere",  
**International J. Multiphase Flow**, Vol. 23, pp. 1-23 (1997).

**J33** Druzhinin, O. and Elghobashi, S., ' DNS of bubble-laden turbulent flows using the two-fluid formulation',  
**Physics of Fluids**, Vol. 10, pp. 685-697 (1998).

**J34** Kim, I. , Elghobashi, S. E., and Sirignano, W. ' On the equation for spherical particle motion : effects of Reynolds and acceleration numbers',  
**J. Fluid Mechanics**, Vol. 367, pp. 221-253 (1998).

**J35** Boratav, O. , Elghobashi, S. E., and Zhong, R.' On the alignment of strain,

vorticity and scalar gradient in turbulent, buoyant, nonpremixed flames',  
**Physics of Fluids**, Vol. 10, pp. 2260-2267 (1998).

**J36** Druzhinin, O. and Elghobashi, S., 'On the decay rate of isotropic turbulence laden with microparticles',  
**Physics of Fluids**, Vol. 11, pp. 602-610 (1999).

**J37** Druzhinin, O. and Elghobashi, S., ' A Lagrangian-Eulerian mapping solver for direct numerical simulation of a bubble-laden homogeneous turbulent shear flow using the two-fluid formulation ',  
**J. Computational Physics**, Vol. 154, pp.174-196 (1999).

**J38** Elghobashi, S. E., Zhong, R. and Boratav, O. ' Effects of gravity on turbulent nonpremixed flames',  
**Physics of Fluids**, Vol. 11 , pp. 3123-3135 (1999).

**J39** Zhong, R. , Elghobashi, S. E., Boratav, O. ' Surface topology of a buoyant turbulent nonpremixed flame',  
**Physics of Fluids**, Vol. 12, pp. 2091-2100 (2000).

**J40** Ahmed, A.M. and Elghobashi, S. E. On the mechanisms of modifying the structure of turbulent homogeneous shear flows by dispersed particles,  
**Physics of Fluids**, Vol. 12, pp. 2906-2930 (2000).

**J41** Druzhinin, O. and Elghobashi, S., ' Direct numerical simulation of a three-dimensional spatially-developing bubble-laden mixing layer with two-way coupling',  
**J. Fluid Mechanics**, Vol. 429, pp. 23-61 (2001).

**J42** Ahmed, A.M. and Elghobashi, S. E. Direct numerical simulation of particle dispersion in homogeneous turbulent shear flows ,  
**Physics of Fluids**, Vol. 13, pp. 3346-3364 (2001).

**J43** Ferrante, A. and Elghobashi, S. E. On the physical mechanisms of two-way coupling in particle-laden isotropic turbulence ,  
**Physics of Fluids**, Vol. 15, pp. 315-329 (2003).

**J44** Ferrante, A. and Elghobashi, S. E., ' A robust method for generating inflow conditions for direct simulations of spatially-developing turbulent boundary layers',  
**J. Computational Physics**, Vol. 198, pp. 372-387 (2004).

**J45** Latz, M. I., Juhl, A. R., Ahmed, A.M., Elghobashi, S. and Rohr, J. ' Hydrodynamic stimulation of dinoflagellate bioluminescence: A computational and experimental study',  
**J. Experimental Biology**, Vol. 207, pp. 1941-1951(2004).

**J46** Ferrante, A. and Elghobashi, S. E., ' On the physical mechanisms of drag reduction in a spatially-developing turbulent boundary layer laden with microbubbles', **J. Fluid Mechanics**, Vol. 503, pp. 345-355. (2004).

**J47** Ferrante, A. and Elghobashi, S. E., Adams P., Valenciano M. and Longmire D. ' Evolution of quasi-streamwise vortex tubes and wall-streaks in a microbubble-laden turbulent boundary layer over a flat plate', **Physics of Fluids**, Vol. 16(9), pp. S2 (2004).

**J48** Ferrante, A. and Elghobashi, S. E., ' Reynolds number effect on drag reduction in a microbubble-laden spatially-developing turbulent boundary layer', **J. Fluid Mechanics**, Vol. 543, pp. 93-106 (2005).

**J49** Ferrante, A. and Elghobashi, S. E., ' On the effects of microbubbles on the Taylor-Green vortex flow', **J. Fluid Mechanics**, Vol. 572 , pp. 145 - 177 (2007).

**J50** Ferrante, A. and Elghobashi, S. E., ' On the accuracy of the two-fluid formulation in DNS of bubble-laden turbulent boundary layers', **Physics of Fluids**, Vol. 19, 045105, pp.1-8 (2007).

**J51** L'vov, V.S., Pomyalov, A., Ferrante, A. and Elghobashi, S. E., ' Analytical model of the time Developing turbulent boundary layer', **J. Exp. Theor. Phys.**, Vol. 86, issue 2, pp. 111-116 (2007).

**J52** Lucci, F., Ferrante, A. and Elghobashi, S. E., ' Modulation of isotropic turbulence by particles of Taylor-lengthscale size', **J. Fluid Mechanics**, Vol. 650, pp. 5-55 (2010).

**J53** Lucci, F., Ferrante, A. and Elghobashi, S. ' Is Stokes number an appropriate indicator of turbulence modulation by large particles ?' **Physics of Fluids**, Vol. 23, pp. 25101-1-7 (2011).

**J54** Cleckler, J., Elghobashi, S. and Liu, F. 'On the motion of inertial particles by sound waves' **Physics of Fluids**, Vol. 24, 033301 (2012).

**J55** Lucci, F., L'Vov, V., Ferrante, A., Rosso, M. and Elghobashi, S. , ' Eulerian-Lagrangian bridge for the energy and dissipation spectra in isotropic turbulence ', **Theoretical and Computational Fluid Dynamics**, DOI: 10.1007/s00162-013-0310-5(2013).

**J56** Wang, Y. and Elghobashi, S. , ' On locating the obstruction in the upper

airway via numerical simulation ',

**J. Respiratory Physiology & Neurobiology**, Vol. 193, pp.1-10 (2014).

**J57** Mylavarapu, G., Wang, Y., Elghobashi, S. and Gutmark, E. 'PIV measurements and numerical simulations of the flow in a human upper airway phantom', **Biomechanics and Modeling in Mechanobiology**, submitted (2016).

### Archival Conference Papers

**C1** Elghobashi, S.E. and Pun, W.M., "A Theoretical and Experimental Study of Turbulent Diffusion Flames in Cylindrical Furnaces", **Proceedings of Fifteenth Symposium (International) on Combustion**, (1974).

**C2** Elghobashi, S.E., Pratt, D.T., Spalding, D.B. and Srivatsa, S.K., "Unsteady Combustion of Fuel Spray in Jet Engine Afterburners", **Proceedings of Third International Symposium on Air Breathing Engines**, Munich (1976).

**C3** Elghobashi, S.E. and Launder, B.E., "Modeling the Dissipation Rate of Scalar Fluctuations in a Thermal Mixing Layer", **Proceedings of Third Symposium on Turbulent Shear Flows**, (1981).

**C4** Elghobashi, S.E. and Abou Arab, T.W., "A Second Order Turbulence Model for Two-Phase Flows", **Proceedings of Seventh International Heat Transfer Conference**, Munich (1982).

**C5** Elghobashi, S.E. and Prud'homme, M., "On the Accuracy and Stability of Quadratic Upstream Differencing in Laminar Elliptic Flows", **Numerical Methods in Laminar and Turbulent Flow**, ed. Taylor, C., Johnson, J., and Smith, W., Pineridge Press, U.K., pp. 317-327 (1983).

**C6** Mostafa A.A. and Elghobashi, S.E., "A Study of the Motion of Vaporizing Droplets in a Turbulent Flow", **Proceedings of Ninth International Colloquium and Dynamics of Explosions and Reactive Systems**, Poitiers, France, July (1983).

**C7** Elghobashi, S.E., Abou Arab, T.W., Rizk, M. and Mostafa, A., "A Mathematical Model of the Turbulent Two-Phase Round Jet", **Proceedings of Fourth International Symposium on Turbulent Shear Flows**, Karlsruhe, Germany, Sept. (1983).

**C8** Elghobashi, S.E., Rizk, M. and Mostafa, A., "A Mathematical Model of the Two-Phase Turbulent Axisymmetric Jet", **Proceedings of the Third Multi-Phase Flow and Heat Transfer Symposium**, Miami, Florida, April (1983).

**C9** Prud'homme, M. and Elghobashi, S.E., "Prediction of Wall-Bounded Turbulent Flows with an Improved Version of a Reynolds-Stress Model", **Proceedings of Fourth International Symposium on Turbulent Shear Flows**, Karlsruhe, Germany, Sept. (1983).

**C10** Elghobashi, S.E. and J.C. LaRue, "The Effect of Mechanical Strain on the Dissipation Rate of a Scalar Variance", **Proceedings of Fourth International Sym-**

posium on Turbulent Shear Flows, Karlsruhe, Germany, Sept. (1983).

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**A40** Ahmed, A. and Elghobashi, S. " On the physical mechanisms of modifying the structure of turbulent homogeneous shear flows by dispersed particles " **53rd Annual Meeting of American Physical Society**, Div. Fluid Dynamics, Washington D.C., November 2000.

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**A63** Elghobashi, S. “ On the accuracy of the two- fluid formulation in DNS of a microbubble-laden turbulent boundary layer”, **ONR 2006 Ship Wave-breaking and Bubble Wake Review**, Caltech, Pasadena, CA, March 29-30, 2006.

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“How do dispersed inertial particles modify turbulent flows ?” **École Polytechnique**, The Hydrodynamics Laboratory (LadHyX), **Palaiseau, France**, June 14, 2013.

“How do dispersed inertial particles modify turbulent flows ?” **University of California, San Diego**, Mechanical and Aerospace Engineering Dept., June 3, 2013.

“Direct numerical simulation of the flow in the upper airway via lattice Boltzmann method” **National Institute of Health**, Bethesda, MD, April 29, 2013.

“On the physical mechanisms of drag reduction in a spatially-developing turbulent boundary layer laden with microbubbles ” **École Normal Supérieur, Paris, France**, March 17, 2011.

“Direct numerical simulation of the flow in the upper airway via lattice Boltzmann method” **National Institute of Health**, Bethesda, MD, Feb. 24, 2011.

“Turbulence modulation by dispersed inertial particles” Mech. Eng. Dept., **Univ. of California, Berkeley**, February 11, 2011.

“ On the two-way interactions between dispersed particles and turbulent flows” **School of Engineering and Mathematical Sciences, City University, London, England**, March 26, 2009.

“On the effects of finite-size solid particles on decaying isotropic turbulence”, **Institut de Mècanique des Fluides de Toulouse, IMFT, Toulouse, France**, June 28, 2007.

“On the physical mechanisms of drag reduction in a spatially-developing turbulent boundary layer laden with microbubbles ” **École Polytechnique**, The Hydrodynamics Laboratory (LadHyX), **Palaiseau, France**, June 26, 2007.

“Turbulence modification in flows laden with particles or bubbles” **The Johns Hopkins University**, Mechanical Engineering Department, February 15, 2007.

“ Direct simulation of turbulent flows laden with particles or bubbles”, **Invited Lecture, CIEMAT : Research Centre for Energy, Environment and Technology, Madrid, Spain**, June 21, 2006.

”On drag reduction in a spatially-developing turbulent boundary layer laden with microbubbles”, **Department of Mechanics and Aeronautics, University of Rome ”La Sapienza”, Rome,, Italy**, September 5, 2005.

“On the drag reduction in a mirobubble-laden spatially-developing turbulent boundary

layer,” **School of Mechanical and Aerospace Engineering, Center for Turbulence and Flow Control Research, Seoul National University, Seoul, South Korea**, May 27, 2005.

“On the physical mechanisms of drag reduction in a mirobubble-laden turbulent boundary layer”, **Department of Mechanical Engineering, University of Tokyo, Japan, June 7, 2004.**

“On the physical mechanisms of drag reduction in a spatially-developing turbulent boundary layer laden with microbubbles”, **Mech. Eng. Dept., Univ. California, Santa Barbara, California**, February 14, 2004.

“Recent advances in DNS of particle-laden turbulent flows ”, **Institute for Scientific Computing Research, Lawrence Livermore Research Laboratory, Livermore, California** , August 7, 2003.

“DNS of turbulent flows laden with particles ”, **Institute for Scientific Computing Research, Lawrence Livermore Research Laboratory, Livermore, California** , March 27, 2003.

“ On the physical mechanisms of modifying the structure of turbulent homogeneous shear flows by dispersed particles”, **Mechanical Engineering Dept., Stanford University, Stanford, California**, October 30, 2001.

“Recent Advances in DNS of Turbulent Flows Laden with Particles, Droplets or Bubbles”, **Universite Pierre et Marie Curie, Paris, France**, September 19, 2001.

“Recent advances in direct numerical simulations (DNS) of turbulent shear flows laden with particles ”, **Institute for Scientific Computing Research, Lawrence Livermore Research Laboratory, Livermore, California** , May 4, 2001.

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” On the physical mechanisms of modifying the structure of turbulent homogeneous shear flows by dispersed particles ”, **ETH, Zürich, Switzerland**, October 4, 2000.

” Recent advances in direct numerical simulations (DNS) of turbulent shear flows laden with particles ”, **Paul Scherer Institute, Villigen, Switzerland**, October 3, 2000.

” Recent advances in direct numerical simulations (DNS) of turbulent shear flows laden with particles and bubbles”, **Mechanical Engineering Department, Imperial College, London**, April 6, 2000.

” Recent advances in direct numerical simulations (DNS) of turbulent shear flows laden with particles and bubbles”, **Mechanical and Aerospace Engineering Department, Univ. California, San Diego**, March 15, 2000.

” Direct numerical simulation of particle-laden flows: the trajectory and two-fluid approaches”, **Dept. of Mechanical Engineering, Univ. of Illinois, Urbana-Champaign**, November 9, 1999.

” Evolution of flame surface in buoyant and nonbuoyant turbulent nonpremixed reactions”, **Graduate Aeronautical Laboratories, California Institute of Technology**, January 16, 1998.

” How do particles modify the turbulence energy in a homogeneous shear flow ?”, **Department of Chemical Engineering, Univ. of California, Santa Barbara**, April 16, 1997.

” Direct numerical simulation of particle-laden homogeneous turbulent shear flows”, **CEA : Atomic Energy Commision - Military Applications Division**, Bordeaux, France, April 2, 1997.

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” DNS of surface topology of turbulent nonpremixed flames ”, **CEA : Atomic Energy Commision - Military Applications Division**, Bordeaux, France, April 2, 1997.

”Effects of buoyancy on turbulent diffusion flames”, Dept. of Mechanical Engineering, **Yale University**, June 10, 1996.

”Particle dispersion and turbulence modification in a homogeneous shear flow”, Dept. of Mechanical Engineering, **California Institute of Technology**, April 23, 1996.

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” On the two-way interaction between homogeneous turbulence and dispersed solid particles”, **Naval Command, Control and Ocean Surveillance Center, San Diego, CA**, Oct. 19, 1993.

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” Direct numerical simulation of particle dispersion and turbulence modulation in homogeneous turbulence”, **NATO Advanced Research Workshop on Chaotic Advection, Tracer Dynamics, and Turbulent Dispersion, Alessandria, Italy**, May 24-28, 1993.

” On predicting particle-laden turbulent flows”, Workshop on turbulence in particulate multiphase flow, **Fluid Dynamics Laboratory, Battelle Pacific Northwest Laboratory, Richland, WA**, March 22, 1993.

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” On the modification of energy spectrum of homogeneous turbulence by dispersed solid particles”, **Department of Mathematics, UCI**, May 21, 1992.

” The two-way coupling between solid particles and homogeneous decaying turbulence”, **Mechanical and Aerospace Engineering Department, Princeton University**, August 23, 1991.

” Direct simulation of particle-laden homogeneous turbulence”, **Los Alamos National Laboratory**, May 25, 1991.

”The effect of turbulence on the propagation of an electromagnetic wave in a compressible turbulent boundary layer”, Workshop on Aerothermal Technology Development, **U.S. Strategic Defense Command , Huntsville, Alabama**, June 13, 1991.

”Direct numerical simulation and closure modelling of particle-laden turbulent flows”, Workshop on Turbulence Simulation and Modelling , **NASA-Marshall, Huntsville**,

**Alabama**, April 14-15, 1991.

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”Direct numerical simulation and modelling of particle-laden turbulent flows”, **German Aerospace Organization (DLR), Munich, Germany**, December 4, 1989.

”Direct numerical simulation of particle dispersion in homogeneous turbulent flows”, **University of Kaiserslautern, West Germany**, December 5, 1989.

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”Direct numerical simulation of particle dispersion and chemical reaction in turbulent flows”, **G.M. Research Laboratory, Thermal Science Department, Warren, Michigan**, June 22, 1989.

”Direct numerical simulation of stratified turbulent homogeneous shear flow”, **Idaho National Engineering Laboratory, Idaho Falls**, September 8, 1988.

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”Direct simulation of stable stratified turbulent homogeneous shear flows”, **Third International Symposium on Stratified Flows, California Institute of Technology**, February 3-5, 1987.

”Direct simulation of the passive-scalar mixing layer”, **Institut de Mecanique des Fluides, Toulouse, France**, September 11, 1987.

”Direct simulation of stratified homogeneous turbulent shear flow”, **Department of Aerospace Engineering, University of Southern California**, October 8, 1986.

”Direct simulation of stratified homogeneous turbulent shear flow”, **Institut de Mecanique Statistique de la Turbulence, Marseille, France**, October 22, 1986.

”Direct simulation of homogeneous turbulent shear flow”, **Mechanical Engineering Department, University of California, Irvine**, July 22, 1986.

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”Direct simulation of turbulent shear flow with buoyancy”, **Jet Propulsion Laboratory, California Institute of Technology**, May 30, 1986.

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”Direct simulation of turbulent homogeneous shear flow”, **DFVLR, Institute of Atmospheric Physics, Oberpfaffenhofen, West Germany**, June 21, 1985.

”Prediction of the turbulent jet laden with vaporizing droplets” **Dept. of Fluid Mechanics, University of Erlangen, West Germany**, May 22, 1985.

”Experimental study of the turbulent jet laden with particles”, **University of the German Armed Forces, Aerospace Department, Munich, West Germany**, February 7, 1985.

”Measurement and prediction of the turbulent two-phase jet”, **University of Karlsruhe, Mechanical Engineering Dept.**, December 13, 1984.

”Prediction of the turbulent jet laden with solid spherical particles”, **DFVLR, Institute of Atmospheric Physics, Oberpfaffenhofen, West Germany**, December 5, 1984.

”Recent developments in mathematical modeling of dispersed two- phase flows”, presented at the Mechanical Engineering Dept., Technical University of Munich, West Germany, November 27, 1984.

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”Effects of dispersed two-phase flows on turbulence structure”, **Office National d’Etudes et de Recherches Aerospatiales (ONERA), Paris, France**, September 19, 1983.

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”Mathematical models of temperature variance and time-scales for the thermal mixing layer ”, **Institut de Mecanique Statistique de la Turbulence, Marseille, France**, July 8, 1983.

”Experimental and theoretical study of dispersed two-phase turbulent jets”, **Institut de Mecanique des Fluides, Toulouse, France**, July 6, 1983.